IB/2004/050386

Sertifikaat / Certificate

REPUBLIEK VAN SUID AFRIKA

PATENT KANTOOR
DEPARTEMENT VAN HANDEL
EN NYWERHEID

REPUBLIC OF SOUTH AFRICA

PATENT OFFICE
DEPARTMENT OF TRADE AND
INDUSTRY

Hiermee word gesertifiseer dat
This is to certify that

1) South African Provisional Patent Application No. **2003/2617** accompanied by a Provisional Specification was filed at the South African Patent Office on **3 April 2003** in the name of **BROSSEUK, Raymond Brian** in respect of an invention entitled: **" Heavy particle separation "**.

2) On **20 February 2004** an assignment of South African Patent Application No. 2003/2617 from **BROSSEUK, Raymond Brian** to **IE-TEC Licensing Limited** was recorded at the South Africa Patent Office.

3) The photocopy attached hereto is a true copy of the provisional specification and drawings filed with South African Patent Application No. **2003/2617**.

PRIORITY DOCUMENT
SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) OR (b)

Geteken te **PRETORIA** in die Republiek van Suid-Afrika, hierdie **10th** dag van **May 2004**

in the Republic of South Africa, this day of

.....
Registrar of Patents

Form P.2

REPUBLIC OF SOUTH AFRICA — PATENTS ACT, 1978

REGISTER OF PATENTS

OFFICIAL APPLICATION NO. ✓	LODGING DATE : PROVISIONAL	ACCEPTANCE DATE
21 01 2003/2617	22 3 April 2003 ✓	43
INTERNATIONAL CLASSIFICATION	**LODGING DATE : COMPLETE**	**GRANTED DATE**
51	23	

FULL NAME(S) OF APPLICANT(S) / PATENTEE(S)

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APPLICANTS SUBSTITUTED : AANSOEKERS VERVANG — **DATE REGISTERED**

71 Le-Nel Licensing Pty Ltd substituted 20.02.04

ASSIGNEE(S) — **DATE REGISTERED**

71

FULL NAME(S) OF INVENTOR(S)

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PRIORITY CLAIMED	COUNTRY	NUMBER	DATE
N.B. Use international abbreviation for country. (See Schedule 4)	33	31	32

TITLE OF INVENTION

54 HEAVY PARTICLE SEPARATION

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PATENT OF ADDITION NO.	**DATE OF ANY CHANGE**
61	
FRESH APPLICATION BASED ON	**DATE OF ANY CHANGE**

REVENUE PAID -3.4.03 INKOMSTE BETAAL

REPUBLIC OF SOUTH AFRICA 60.00 REPUBLIEK VAN SUID-AFRIKA

Form P.1

REPUBLIC OF SOUTH AFRICA
PATENTS ACT, 1978

PBHR 229

APPLICATION FOR A PATENT AND ACKNOWLEDGEMENT OF RECEIPT
(Section 30 (1) - Regulation 22)
The grant of a patent is hereby requested by the undermentioned applicant on the basis of the present application filed in duplicate.

OFFICIAL APPLICATION NO.	
21 01	2003/2617

DMK REFERENCE
P26460ZA00

FULL NAME(S) OF APPLICANT(S)

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TITLE OF INVENTION

54 HEAVY PARTICLE SEPARATION

THE APPLICANT CLAIMS PRIORITY AS SET OUT ON THE ACCOMPANING FORM P2
The earliest priority claimed is

THIS APPLICATION IS FOR A PATENT OF ADDITION TO PATENT APPLICATION NO. 21 01

THIS APPLICATION IS FRESH APPLICATION IN TERMS OF SECTION 37 AND BASED ON APPLICATION NO. 21 01

THIS APPLICATION IS ACCOMPANIED BY :

x	1a	A single copy of a provisional specification of 13 pages.
	1b	Two copies of a complete specification of pages.
	2a	Informal drawings of sheets.
x	2b	Formal drawings of 2 sheets.
	3	Publication particulars and abstract (form P8 in duplicate).
	4	A copy of figure of the drawings for the abstract.
	5	Assignment of invention (from the inventors) or other evidence of title.
	6	Certified priority document(s).
	7	Translation of priority document(s).
	8	Assignment of priority rights.
	9	A copy of form P2 and a specification of S.A. Patent Application. 21 01
x	10	A declaration and power of attorney on form P3.
	11	Request for ante-dating on form P4.
	12	Request for classification on form P9.
	13a	Request for delay of acceptance on form P4.
	13b	

DATED 3 April 2003

Patent Attorney for Applicant(s)

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REGISTRAR OF PATENTS DESIGNS, TRADE MARKS AND COPYRIGHT RECEIVED COPYRIGHT
OFFICIAL DATE STAMP
2003 -04- 03
REGISTRAR OF PATENTS
REGISTRATEUR VAN PATENTE, MODELLE, HANDELSMERKE EN OUTEURSREG

The duplicate will be returned to the applicant's address for service as proof of lodging but is not valid unless endorsed with official stamp.

D. M. Kisch Inc, Sandton

Form P.6

REPUBLIC OF SOUTH AFRICA

PATENTS ACT, 1978

PROVISIONAL SPECIFICATION

(Section 30 (1) - Regulation 27)

OFFICIAL APPLICATION NO.		LODGING DATE		DMK REFERENCE
21	01 2003/2617	22	3 April 2003	P26460ZA00

FULL NAME(S) OF APPLICANT(S)	
71	BROSSEUK, Raymond Brian

FULL NAME(S) OF INVENTOR(S)	
72	BROSSEUK, Raymond Brian

TITLE OF INVENTION	
54	HEAVY PARTICLE SEPARATION

TITLE OF INVENTION: HEAVY PARTICLE SEPARATION

INTRODUCTION:

This invention relates to heavy particle separation. More particularly, this invention relates to an apparatus and method i.e. a system for heavy particle separation or recovery from ore, gravel, earth, and the like.

BACKGROUND TO THE INVENTION:

The inventor is aware of a variety of apparatus and processes that have been used for extracting heavy particles, such as gold, platinum, lead and the like, from ore, gravel or sand, earth, including placer ore for example in respect of alluvial gold, and the like. Such apparatus and methods suffer from certain problems including a major problem being a failure to recover fine particles. This reduces the efficiency and hence the profitability of such recovery systems.

Another disadvantage is that certain recovery systems involve the use of large quantities of water. Such large quantities of water are not always available at a site where, for example, gold-bearing placer ore is found and processed. Even

in localities where large quantities of water are available, such usage can impact negatively on the environment, and hence large holding ponds or holding tanks are required.

Another disadvantage of conventional placer ore recovery systems is that a surge is created in water flowing through the system with each new load of gravel that is added to the system. This results in loss of fine gold particles.

Further disadvantages of existing gold recovering systems include an extended clean-up time which adds significantly to the cost of operations; the large size of equipment; high capital cost and difficulty of transporting such equipment.

The inventor is also aware of the apparatus and process disclosed in his United States Patent No. 5 108 584, which was granted and published on 28 April 1992. This patent describes an outer and inner barrel arrangement. The inner drum has an upper fragmentation section, an intermediate trommel section and a lower discharge section. A spray of water is directed into the inner barrel. The ore is separated into large tailings that are discharged from the lower end of the inner drum and fine, light tailings from the outer drum. Heavy, fine portions of the material are carried by a spiral on the inside surface of the outer drum and discharged into the upper end of a sluice box from the upper end of the outer drum. The sluice box includes the plurality of landings upon which heavy

material, such as gold, collect. The outer drum may be vibrated to assist in the recovery process.

OBJECTS OF THE INVENTION:

An object of the present invention is to overcome, at least partly, the shortcomings or disadvantages associated with the prior art systems.

Another object of the present invention is to provide an apparatus and method which are both novel and include an inventive step.

SUMMARY OF THE INVENTION:

According to one aspect of the present invention, there is provided a heavy particle recovery apparatus, including a tiltable, transversely operated conveyor belt concavely shaped in its central area, and including a spiral rib provided on the belt outer surface, the rib being adapted to urge material upwardly along the conveyor belt, a material feeder means provided above the conveyor belt and a water spray system also provided above the conveyor belt.

When used in this specification, the expression 'transversely operated conveyor belt, means a conveyor belt in which the conveyor belt travels in a direction transverse to the general flow of material provided thereon (and not in the same direction as is the case with conventional conveyor belts).

The conveyor belt may include a plurality of idler rollers which may be adjustable in a vertical direction to provide a particular, desired concave profile for the conveyor belt.

The apparatus may include a classification system to provide the feeder means with material smaller than about 2.5cm (i.e. less than 1 inch size fraction). In a preferred form of the invention, the material feeder means may include a tilted/sloped chute or conveyor belt which tilts so that it provides an even feed of material to the (main) conveyor belt. Such feeder means may be provided above the belt and near the one side of the (main) belt whilst the water spray system is provided above and near the opposite side of the (main) conveyor belt.

The apparatus may include a suitable tailings trough at the lower end of the conveyor belt and a suitable concentrate trough at the other end of the conveyor belt. The concentrate trough may lead to a suitable sluice box to separate the fine material from the heavier fine fraction from gangue.

The apparatus may include a plurality of idler rollers located between the main rollers. In one form of the invention, the idler rollers may be moveable between a lower position and an upper position so that the concave shape of the belt may be varied in accordance with the feed or capacity of the apparatus.

In a preferred form of the invention, the conveyor belt may be made from a suitable rubber top-coated with a layer of food-grade polyurethane or the conveyor belt may be completely made of PVC or a polyurethane material.

According to another aspect of the present invention, there is provided a method of recovering heavy particles, including the step of using a transversely operated conveyor belt including a tiltable transversely operated conveyor belt including a spiral rib provided on the belt outer surface, the belt being adapted to urge material upwardly along the conveyor belt.

The method may include the step of using a heavy particle recovery apparatus as described herein.

DETAILED DESCRIPTION OF THE INVENTION:

The invention will now be described in greater detail, by way of non-limiting example, with reference to the following drawings, in which:

Fig.1 shows an end view of part of a heavy particle recovery apparatus shown schematically, according to one form of the present invention;

Fig. 2 shows an upper plan view of the apparatus of Fig.1, also shown schematically;

Fig. 3 shows an end view of another heavy metal recovery apparatus shown schematically, according to another form of the present invention; and

Fig. 4 shows an end view of the apparatus of Fig. 3 with the conveyor belt having a different concave section, also shown schematically.

In the drawings, like reference numerals refer to like parts, unless otherwise indicated.

Referring firstly to Figs. 1 and 2, reference numeral 10 refers generally to a heavy particle separation apparatus, shown in schematic form, according to one form of the invention.

The apparatus 10 includes a head or driven roller 12 and a tail roller 14. The roller 12 is driven or rotated by a suitable motor or engine (not shown) through an adjustable speed gearbox (also not shown) which enables the head roller to be driven at a suitable speed, depending on various factors, of between about 2 to about 10 rpm. The rollers 12 and 14 are journalled in suitable bearings (not shown) which in turn are supported by a suitable frame (also not shown) that supports the rollers 12 and 14 and hence the apparatus 10.

A conveyor belt 18 is operatively mounted on the rollers 12 and 14, and preferably made from a base layer of rubber having a thickness of

approximately 40mm having a top coat of food-grade polyurethane thereon of about 10mm thickness. The belt 18 has a continuous spiral rib 20 provided thereon, which is made of rubber.

A plurality of idler rollers 16 are provided between the rollers 12 and 14, in a concave array to support the belt 18 concavely between the rollers 12 and 14, as shown in Fig. 1.

When being set up for use, the belt 18 will have its one end i.e. the lower end as shown in Fig.2, tilted above the horizontal i.e. upwardly out of the plane of the drawing, thereby providing an upper and a lower end. At the lower end, the first two spirals of the rib 20 as shown in the drawing will be doubled to about 80mm in height whilst for the rest of the rib, the height will be approximately 40mm in height.

A water supply pipe 22 is provided along the one side of the belt 18, including a plurality of downwardly pointing spray nozzles 22.1 intended to spray water on the upper surface of the conveyor belt 18 and thereby to lubricate the surface of the belt 18.

Provided above and along the opposing side of the belt 18 is an ore feeder means in the form of a downwardly tilted or sloped channel-shaped chute 24

which will feed ore including heavy metal particles in the direction shown firstly by the arrow 24.1 and then by the arrow 24.2 onto the surface of the belt 18.

The apparatus 10 includes other component parts such as a tailings trough (not shown) to receive concentrate shown by the arrow 18.3 at the upper end of the belt 18. The concentrate trough leads to a sluice box (also not shown) for example, and these parts will be discussed hereunder.

In one form of the invention, in order to process large quantities of material, for example about 200 tons per hour, the apparatus 10 may have the following dimensions:

Each of the rollers 12 and 14 may be about 60cm in diameter, the overall width of the belt 18 may be about 5m and the length of the conveyor belt may be about 7.5m, with the rotational speed of the rollers 12 and 14 being about 40 rpm. The angular inclination of the apparatus 10 may be about 3 to 6 degrees from the horizontal.

Referring next to Figs. 3 and 4, idler rollers 16 are shown, essentially to support the belt 18 along its upper run or to space the belt from the support frame of the apparatus and thereby to prevent damage to the belt 18 along its lower run. In Fig. 3 the idler rollers 16 are shown in a lower position to provide the belt 18 and hence the apparatus 10 with a maximum capacity of up to about 400 tons per

hour. It will be seen that each idler roller 16 is mounted on an adjustable arm 16.1 which may be pivoted and thereby raised to a vertical position (as shown in Fig. 4) to provide a different concave profile for the belt 18 i.e. to provide a smaller concave profile which can for example deal with a minimum capacity of about 50 tons per hour. The adjustable arms 16.1 are secured by means of suitable brackets and nuts and bolts (not shown) to the belt support framework as shown in Figs. 3 and 4.

For this capacity and this belt profile, the water supply pipe 22 may be moved accordingly to the right hand side of the drawing to ensure that the water nozzles 22.1 provide water operatively in the concave section of the belt 18, as shown in Fig. 4.

In use, the apparatus 10 is operated as set out hereunder

Material containing heavy particles, or alluvial gravel for example, is first classified in any manner known in the prior art to produce gravel or particles having a size less than 1 inch or less than about 2.5cm (in other words a fraction size of minus 1 inch). This material is then fed in the direction shown by arrow 24.1 along the chute 24 onto the belt 18 as shown by the arrows 24.2. The belt 18 is driven by the roller 12 which in turn is rotatably driven in the direction indicated by arrow 12.1.

Hence the belt 18 is driven in the direction indicated by arrow 18.1 at a speed determined by the rotational speed of the rollers 12 and 14 which are rotated at about 40 rpm.

Water from the nozzles 22.1 on the pipe 22 spray water downwardly onto the belt 18, and such water will be provided in counter-current fashion both because it will flow contrary to the direction of the arrow 18.1 due to the concave shape of the belt 18 and contrary to the general flow downwardly because the belt 18 is tilted upwardly at the lower end of the drawing in Fig.2

The spiral 20 will tend to move the material upwardly along the slope i.e. upwardly along the belt 18 whilst water sprayed from the nozzles 22.1 will flow counter-current to such flow i.e. downwardly along the slope of the belt 18.

This will result in waste moving downwardly i.e. light weight particles of gravel or stones moving downwardly in the direction of the arrow 18.2 whilst heavy weight concentrate will tend to move upwardly along the belt, urged by the spiral 20 and as shown by the arrow 18.3 to exit the belt 18 at its upper end at the site of the arrow 18.3 into a concentrate trough (not shown). Light weight particles of gravel or stones will move downwardly in the direction of arrow 18.2 and exit the belt 18 at the site of the arrow 18.2 into a tailings trough (also not shown).

Generally speaking, larger nuggets and particles of heavy material, such as gold, will be trapped ahead of the spiral 20 and such particles, including fine particles of material, will be washed by water sprayed onto the belt 18 from the nozzles 22.1 back into the concave or hollow part of the belt 18 and will move in the direction indicated by the arrow 18.2.

Consequently, concentrate, which generally speaking will amount to about 5% in alluvial gold mining and upwards of 50% in hard rock ore of the total volume of ore fed onto the belt 18, will exit the belt as shown by the arrow 18.3.

When the concentrate leaves the belt as shown by the arrow 18.3, it will drop into the tailing trough (not shown) from where it will be fed into a sluice box (also not shown) or other suitable means, where the heavy metal, for example gold, will be suitably separated from the fine material.

In this manner, the apparatus 10, and the method provided thereby, will produce a high recovery rate of heavy metal, for example gold, typically in excess of about 98 or 99%.

Although not shown, the belt 18 and the rollers 12 and 14, and the frame on which these are mounted, can conveniently be mounted on a mobile trailer which can be transported by rail and/or by road. Either such trailer may conveniently have a suitable jacking means at one end to elevate or tilt the

conveyor belt suitably or alternatively, the framework may have its own jacking or tilting means to provide the necessary gradient for the apparatus 10 and hence for the belt 18.

It will therefore be seen that a novel and inventive apparatus and method i.e. system is provided for recovering heavy mineral particles, such as gold, from ore, gravel, or the like in a simple and an efficient manner which requires minimal water consumption. Naturally the water used on the belt may be recycled after settling or filtration, as may be required. Similarly the water used in the sluice box may also be recycled, as appropriate.

The apparatus and method of the invention therefore provide a relatively inexpensive and cost-efficient system for recovering or separating heavy minerals from ore, gravel, or the like, relative to existing or prior art systems.

Although certain embodiments only of the invention have been described and/or exemplified herein, it will be apparent to any person skilled in the art that other possibilities, modifications and/or variations of the invention are possible. Such possibilities, modifications and/or variations are therefore to be considered as falling within the spirit and scope of the invention as herein described and/or exemplified.

Dated this 3 day of April 2003

Patent Attorney / Agent for the Applicant

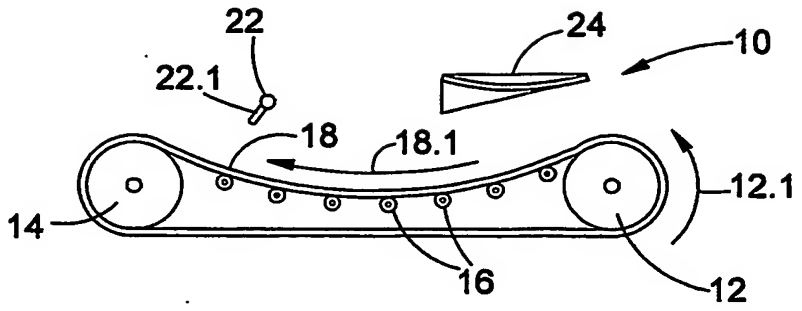

FIGURE 1

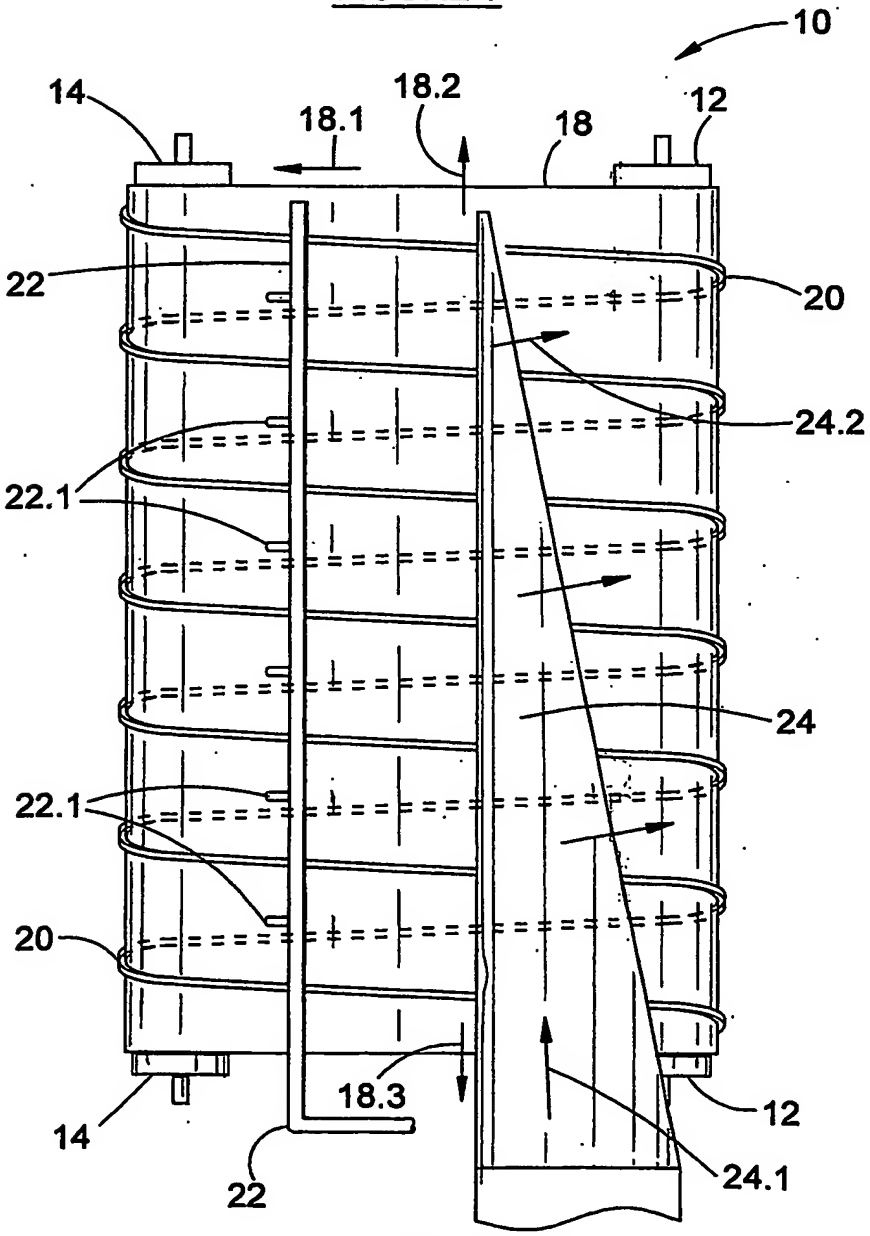

FIGURE 2

BROSSEUK, RAYMOND

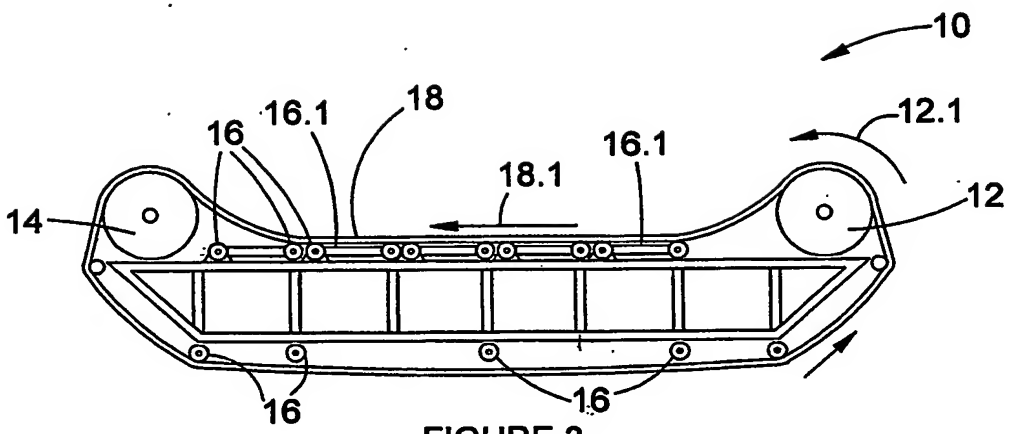

FIGURE 3

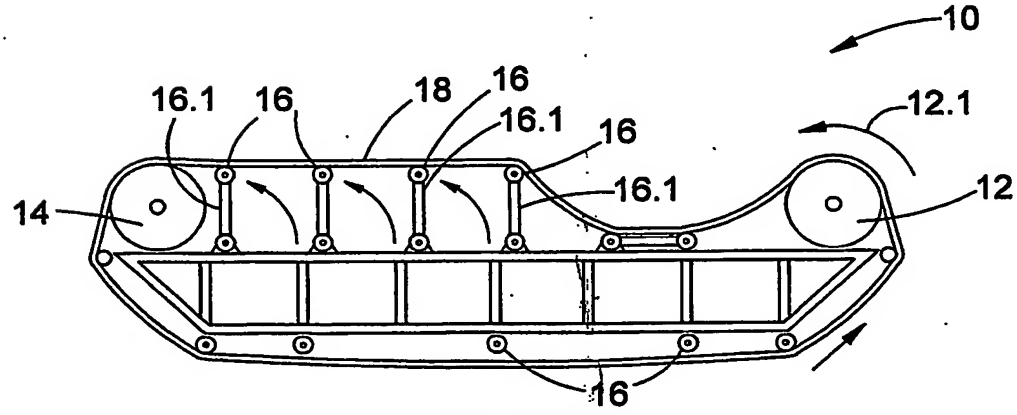

FIGURE 4